REMARKS

This Amendment is filed in response to the Office Action dated April 2, 2004, which has a shortened statutory period set to expire June 2, 2004.

Final Office Action Maintains Identical Rejections As First Office Action

The section of the Final Office Action entitled, "Claim Rejections" is identical to that set forth in the First Office Action dated October 16, 2003. Applicants fully responded to those rejections in an Amendment In Response To The First Office Action dated January 5, 2004. Applicants respectfully maintain that Claims 1-10, 12-32, 34-36, and 44-54 are not anticipated by Agrawal for reasons provided in that Office Action Response. For brevity, Applicants are herein incorporating those reasons by reference. Applicants will now respond to the section of the Final Office Action entitled, "Remarks".

Applicants Traverse New Characterizations In Final Office Action

Performing layout beautification is not the same as correcting for optical proximity, as taught by Applicants in paragraphs [0003]-[0006] of the Specification (quoted below for the Examiner's convenience).

> [0003] Automated design tools can be used to perform various operations on an IC layout. For example, an automated tool might be used to make optical proximity correction (OPC) modifications or perform design rule checking (DRC) on an IC layout. An automated tool could even be used to create the actual IC layout from a design netlist.
>
> [0004] However, while automated tools enable the accurate creation of IC layouts, the complex interactions of the rules embodied in those tools can result in layout imperfections.

In other words, while the results of an automated tool may be electrically correct (and even optically correct), the polygons that make up the actual IC layout might include unintended irregularities. These "layout imperfections" are not necessarily defects in the sense that the IC layout may still be electrically correct. However, these layout imperfections may adversely affect layout printability or device performance. Also, such imperfections can significantly increase data volume for a particular IC layout, thereby undesirably increasing layout processing (e.g., OPC, DRC, etc.) and mask production times.

[0005] For example, Fig. 1a shows a simple polygon 100 made up of edges 101-108. Polygon 100 could represent a simple wire or interconnect in an IC layout. A notch 111 in the side of polygon 100 represents a common type of layout imperfection. If notch 111 is small, it may cause no significant electrical or optical problems. However, as shown in Fig. 1b, during a fracturing operation notch 111 causes polygon 100 to be split into primitives 121, 122, and 123, along fracture lines 131 and 132. In contrast, Fig. 1c shows a polygon 140 that is substantially similar to polygon 100, but does not have the same notch-type imperfection. As a result, polygon 100 would fracture into a single primitive. Thus, the small imperfection in polygon 100 (i.e., notch 111 shown in Fig. 1b) results in a three-fold increase in data volume after a fracturing operation.

[0006] Unfortunately, due to the complexity of modern IC layouts, detecting and correcting this type of layout imperfection (a technique sometimes referred to as "layout beautification") can be difficult.

OPC involves modifications of the original IC layout to compensate for distortions introduced by the exposure process. Agrawal, col. 1, lines 33-39. As described in the Specification, paragraph [0004] (see above), performing OPC (or other automatic layout modifications) can result in the need for layout beautification. Thus, it logically follows that

performing a layout beautification operation would occur after performing optical proximity correction (OPC). Unfortunately, the Final Office Action confuses these distinctions between OPC and layout beautification.

For example, col. 2, lines 13-20 of Agrawal teach that OPC modifications can be applied to a "finger" layout feature, which is common in IC layouts. Therefore, contrary to the characterization in the Final Office Action, this passage fails to disclose or suggest performing layout beautification.

Col. 3, lines 23-30 of Agrawal teach that a catalog of shapes can be defined and layout processing actions can be formulated based on the properties of the various shapes. Applicants submit that the catalog of shapes for OPC would differ from the catalog of shapes for layout beautification. Notably, contrary to the characterization in the Final Office Action, this passage fails to equate OPC and layout beautification.

Figs. 10a and 10b of Agrawal illustrate a shape-based OPC system and OPC engine, respectively. Contrary to the characterization in the Final Office Action, these figures fail to disclose or suggest that an OPC engine and a layout beautification engine have equivalent functions.

Col. 8, lines 51-54 of Agrawal teach that the shapes/actions of a layout modification system may be provided as defaults by the system, or the user may add or modify shapes/actions as desired. Contrary to the characterization in the Final Office Action, this passage fails to disclose or suggest a second set of instructions for performing a first layout beautification action on each of the first set of matching layout features as recited in Claim 32.

Col. 20, lines 23-24 of Agrawal teach that computer software for performing layout processing can include code for

applying a first action to a first set of layout features. Contrary to the characterization in the Final Office Action, this passage also fails to disclose or suggest a second set of instructions for performing a first layout beautification action on each of the first set of matching layout features as recited in Claim 32.

Fig. 10b of Agrawal illustrates an exemplary OPC engine. Contrary to the characterization in the Final Office Action, this figure fails to disclose or suggest an apparatus for reducing output data size in an input layout by beautifying the input layout as recited in Claim 44.

Col. 12, lines 54-57 and col. 15, lines 44-46 of Agrawal teach that a data controller can segregate the data into primitives, i.e. elements appropriate for a shape scanner. As taught by Applicants in the Specification, paragraph [0005] (see above) and referring to Figs. 1a and 1b, even a small imperfection in a polygon can result in a significant increase in data volume after a fracturing operation. Therefore, it is unclear how the segmentation of Agrawal, without layout beautification, can result in reducing output data size as recited in Claim 44.

Col. 8, lines 37-48 of Agrawal teach that once a catalog of shapes is specified, actions may be formulated as functions of the property variables of those shapes. Actions may include instructions to perform a modification, e.g. a rule-based OPC, or any other response to a particular set of parameters. Contrary to the characterization in the Final Office Action, this passage fails to disclose or suggest an apparatus for reducing output data size in an input layout by beautifying the input layout as recited in Claim 44.

Claims 1-54 Are Patentable Over Agrawal

Agrawal fails to disclose or suggest performing a layout beautification operation as recited in Claims 1 and 12. Therefore, Applicants request reconsideration and withdrawal of the rejection of Claims 1 and 12.

Claims 2-11 depend from Claim 1 and therefore are patentable for at least the reasons presented above for Claim 1. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 2-11.

Claims 13-18 depend from Claim 12 and therefore are patentable for at least the reasons presented above for Claim 12. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 13-18.

Claim 19 recites a layout beautification engine. Agrawal fails to disclose or suggest a layout beautification engine. Therefore, Applicants request reconsideration and withdrawal of the rejection of Claim 19.

Claims 20-25 depend from Claim 19 and therefore are patentable for at least the reasons presented above for Claim 12. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 20-25.

Claim 26 recites a system for performing layout beautification on an IC layout data file. Therefore, Claim 26 is patentable for substantially the reasons presented above for Claim 19. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claim 26.

Claims 27-31 depend from Claim 26 and therefore are patentable for at least the reasons presented above for Claim 26. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 27-31.

Claim 32 recites a software program for performing layout beautification on a plurality of polygons in an IC layout. This

software program includes a second set of instructions for performing a first layout beautification action on each of the first set of matching layout features. Therefore, Claim 32 is patentable for substantially the reasons presented above for Claim 19. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claim 32.

Claims 33-39 depend from Claim 32 and therefore are patentable for at least the reasons presented above for Claim 32. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 33-43.

Claim 44 recites an apparatus for reducing output data size in an input layout by beautifying the input layout. Therefore, Claim 44 is patentable for substantially the reasons presented above for Claim 19. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claim 44.

Claim 45 depends from Claim 44 and therefore is patentable for at least the reasons presented above for Claim 44. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claim 45.

Claim 46 recites modifying the layout according to corrective actions associated with the identified shape patterns, thereby removing at least one layout imperfection. Therefore, Claim 46 is patentable for substantially the same reasons as presented for Claims 1 and 12.

Claims 47-50 depend from Claim 46 and therefore are patentable for at least the reasons presented above for Claim 46. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 47-50.

Claim 51 recites a shape-based beautification method in a layout. Therefore, Claim 51 is patentable for substantially the reasons presented above for Claim 19. Based on all of the above

reasons, Applicants request reconsideration and withdrawal of the rejection of Claim 51.

Claims 52-54 depend from Claim 51 and therefore are patentable for at least the reasons presented above for Claim 51. Based on those reasons, Applicants also request reconsideration and withdrawal of the rejection of Claims 52-54.

CONCLUSION

Claims 1-54 are pending in the present application. Applicants request allowance of these claims.

If there are any questions, please telephone the undersigned at 408-451-5907 to expedite prosecution of this case.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service as FIRST CLASS MAIL in an envelope addressed to: Mail Stop AF Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on May 18, 2004.

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Signature: Rebecca A. Baumann